

**CLAIMS**

1. A polarization mode dispersion compensator comprising:  
a polarization transformer to transform polarization of  
5 an input optical signal;  
a compensating optical unit to compensate for a  
polarization mode dispersion of the input optical signal and  
output an output optical signal;  
a polarimeter to measure a state of polarization and a  
10 degree of polarization of the output optical signal and generate  
a feedback signal indicating the measured state of polarization  
and degree of polarization; and  
a control circuit to generate, based on the feedback signal,  
control signals for adjusting the polarization transformer in  
15 such a way that a plurality of target states of polarization  
in which the degree of polarization is measured are realized  
in output optical signals in following operations.
2. The polarization mode dispersion compensator according  
20 to claim 1, wherein  
the polarization transformer is realized by multiple  
three-electrode structures on a  $\text{LiNbO}_3$  substrate, whereby  
control voltages are applied such that a device operation of  
the polarization transformer corresponds to endless rotatable  
25 waveplates.
3. The polarization mode dispersion compensator according  
to claim 1, wherein  
the compensating optical unit is realized in such a way  
30 that an amount of differential group delay is introduced by one  
of a polarization maintaining fiber and a birefringent crystal.
4. The polarization mode dispersion compensator according  
to claim 1, wherein  
35 the compensating optical unit comprises a plurality of

sections of differential group delay introducing elements separated by at least one individually controllable variable retarder with an eigenaxis oriented at an angle of 45 degree with respect to an eigenaxis of each of two adjacent differential group delay introducing elements.

5        5.     The polarization mode dispersion compensator according to claim 1, wherein  
         the control circuit generates the control signals for  
10     adjusting the polarization transformer in such a way that an optimum state is found from among the target states of polarization by searching for a state with the maximum degree of polarization in a circumference of an actual state in a polarization space.

15       6.     The polarization mode dispersion compensator according to claim 5, wherein  
         the control circuit records the measured state of polarization and degree of polarization, and calculates from  
20     polarization changes control signals for adjusting the polarization transformer in such a way that the target states of polarization are equally separated from each other and equally distant from the actual state in the polarization space.

25       7.     The polarization mode dispersion compensator according to claim 6, wherein  
         the target states of polarization are preset and located on a circle around the actual state at a predefined distance in the polarization space.

30       8.     The polarization mode dispersion compensator according to claim 5, wherein  
         the control circuit records the measured state of polarization and degree of polarization, calculates from  
35     polarization changes control signals for adjusting the

polarization transformer in such a way that the target states of polarization are unequally separated from each other and unequally distant from the actual state in the polarization space, and weights measured degrees of polarization in the target states of polarization by using a distance between each target state of polarization and the actual state in the polarization space.

9. The polarization mode dispersion compensator according to claim 1, wherein

the control circuit recognizes changing device characteristics of the polarization transformer in a case where a part of the target states of polarization are not realized, and takes countermeasures such that the polarization transformer operates like endless rotatable waveplates by recalculating a voltage which describes the device characteristics of the polarization transformer and generating a control signal for applying the calculated voltage to the polarization transformer.

10. A polarization mode dispersion compensator comprising:  
a polarization transformer to transform polarization of an input optical signal;

a compensating optical unit to compensate for a polarization mode dispersion of the input optical signal and output an output optical signal;

a distortion analyzer to measure a state of polarization and a distortion of the output optical signal and generate a feedback signal indicating the measured state of polarization and distortion; and

a control circuit to generate, based on the feedback signal, control signals for adjusting the polarization transformer in such a way that a plurality of target states of polarization in which the distortion is measured are realized in output optical signals in following operations.

11. A method of polarization mode dispersion compensation,

comprising:

transforming polarization of an input optical signal through a polarization transformer;

5 compensating for a polarization mode dispersion of the input optical signal through a compensating optical unit to generate an output optical signal;

measuring a state of polarization and a distortion of the output optical signal to generate a feedback signal indicating the measured state of polarization and distortion; and

10 adjusting the polarization transformer according to the feedback signal in such a way that a plurality of target states of polarization in which the distortion is measured are realized in output optical signals in following operations.